

REPORT DOCUMENTATION PAGE					Form Approved OMB No. 0704-0188	
The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.						
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.						
1. REPORT DATE (DD-MM-YYYY) 3/31/09		2. REPORT TYPE Final report		3. DATES COVERED (From - To) 05/01/2004 - 12/31/2006		
4. TITLE AND SUBTITLE  Final Report: High-Frequency Acoustic Billboard Array for High Spatial Resolution Measurements of the Ocean Sound Field				5a. CONTRACT NUMBER		
				5b. GRANT NUMBER N00014-04-1-0582		
				5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) D'Spain, Gerald L.				5d. PROJECT NUMBER		
				5e. TASK NUMBER		
				5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Marine Physical Laboratory of the Scripps Institution of Oceanography University of California, San Diego 291 Rosecrans Street San Diego, California 92106				8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research One Liberty Center 875 N. Randolph Street, ONR 321 Arlington, VA 22203-1995 Charles Traweek				10. SPONSOR/MONITOR'S ACRONYM(S) ONR		
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Distribution unlimited						
13. SUPPLEMENTARY NOTES						
14. ABSTRACT  This DURIP/ONR project (N00014-04-1-0582) was to design and construct a 128-element, high-frequency (15 kHz design frequency) billboard array to be used in our High-Frequency/Mid-Frequency Passive Processing (HF/MF) program.						
15. SUBJECT TERMS HF/MF, billboard array, signal processing						
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT  None	18. NUMBER OF PAGES  2	19a. NAME OF RESPONSIBLE PERSON Anne J. Footer	
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (Include area code) 858-534-1802	

Reset



## *Final Report*

# **High-Frequency Acoustic Billboard Array for High Spatial Resolution Measurements of the Ocean Sound Field**

**ONR Grant N00014-04-1-0582**

Gerald L. D'Spain

*Marine Physical Laboratory  
Scripps Institution of Oceanography  
La Jolla, CA 92093-0701*

The original purpose of this DURIP grant was to design and construct a 128-element, high-frequency (15 kHz design frequency) billboard array to be used in our High-Frequency/Mid-Frequency Passive Processing (HF/MF) program. However, after the DURIP proposal was submitted but before the winners of the awards were announced, the ONR sponsor of our HF/MF program decided that he had sufficient funds in his core program to pay for the design and construction of the billboard array. Therefore, after consulting with Mike Traweek, the ONR sponsor who encouraged support for this DURIP, we redirected the funds in the grant into three areas 1) redesign and modification of our 128-element mid-frequency billboard array so that its design frequency was increased from 3.75 kHz to 5 kHz and its wet-end data acquisition system was identical to that of the new high-frequency array, 2) acquisition of 60 low-noise, low-power hydrophones from High Tech, Inc for use in our autonomous underwater vehicle program, and 3) acquisition of four 4-component acoustic vector sensors of advanced design from Wilcoxon Research, to be used in various applications including our autonomous underwater vehicle program.

A one-year no-cost extension was requested in the program because of the long lead-time on the acoustic sensors, both the hydrophones and the vector sensors. By the end of the second year of the grant, all funds had been expended on the three areas listed above. The modified mid-frequency array (along with the new high frequency array) were deployed from R/P FLIP in March/April, 2006 as part of our HF/MF Passive Processing program (sponsored by Code 321-US) and together they recorded over 18 TBytes of data during the 10-day period of the experiment. Analyses of these data, ongoing at present, have resulted in some very interesting features in the ocean sound field as well as provided information of direct relevance to the U.S. Navy. In addition, both arrays were taken to the Lake Seneca Calibration Facility in May, 2007 to conduct in-situ calibration measurements. This week-long effort also was highly successful and analyses of these data have just started.

In July, 2007, our prop-driven Bluefin 21 AUV was taken to sea equipped with a set of the High Tech hydrophones and an acoustic vector sensor as part of the ONR-sponsored PLUSNet program, Code 32-SP. Both sensor systems provided high quality

data. More recently, we have been flying our underwater flying wing glider with a 32-element High Tech hydrophone array all along its leading edge and a Wilcoxon acoustic vector sensor in its nose. This effort is part of our Flying Wing Underwater Glider program supported by ONR Code 321-OE. Analyses of these data will continue over the next year.

We expect the modified mid-frequency array, the new High Tech hydrophones, and the Wilcoxon vector sensors to continue to provide unique at-sea data collection opportunities for several years to come.